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Low Emission Development Strategy – Transport Sector



September 2016

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DISCLAIMER

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

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Content

1. Transport today.....	1
2. Transport Sector Low Emission Development Strategy Vision for 2030	4
3. Transport sector Low Emission Development roadmap	8

Figures

Fig. 1. Energy consumption and CO ₂ emissions in transport sector by energy carriers, 2014.....	1
Fig. 2. Energy consumption and CO ₂ emissions in transport sector by transportation types, 2014.....	2
Fig 3. GHG emissions projections in Transport and Energy generation sectors according to BAU and reduction measures scenarios in 2014-2030.	7

Abbreviations and Symbols

PJ	Petajoule (10^{15} Joule)
Gg	Gigagram ($10^9\text{G}=10^3\text{T}$)
GWh	Gigawatt-hour (10^9 W.h)
MW	Megawatt (10^6 W)
BAU	Business As Usual
EBRD	European Bank for Reconstruction and Development
CO ₂	Carbon dioxide
CH ₄	Methane
N ₂ O	Nitrous oxide
GJ	Gigajoule (10^9 Joule)
TJ	Terajoule (10^{12} Joule)
NO	Nitrogen monoxide
NO _x	Nitrogen oxides
EC-LEDS	Enhancing Capacity for Low Emission Development Strategies
N ₂	Molecular nitrogen
KWh	Kilowatt-hour (10^3 W.h)

I. Transport today

Four main sub-sectors¹ — (1) road transport, (2) railway, (3) marine transport, and (4) aviation, — constitute transport sector of Georgia. At least one of these four sub-sectors link together Georgian regions, municipalities, cities or villages, and connect country to its neighbors. In 2014 transport sector employed 45 381 people and its turnover reached 3 916.2 million GEL². Compared to 2000, this figure has increased by 746.6%, while the growth in employment reached 7.4%.

According to National Statistics Office of Georgia (GeoStat), in 2014 transport sector consumed 55.56PJ energy equivalent — one third of country's total final consumption. 52.14PJ out of this total amount was Georgia's internal consumption, while the rest was consumed by international aviation.

In 2014, diesel fuel (42.3%) led Georgia's fuel consumption in transport sector, while the runner up was petrol (32.1%) and the natural gas (23.5%) was on the third place. In the same year, Georgian Railway and Tbilisi Metro, including a cable transport with trivial share, consumed 0.96PJ electricity (1.84%) in the transportation sector.

Due to fossil fuel consumption transport sector emitted 487.8 GgCO₂ equivalent GHG (37.1% of Georgia's total GHG emissions) in 2014 and 99.1% (3 458 Gg) of these emissions were carbon dioxide. Including an indirect emission from electricity consumption (emission factor equals to 0.115 tons of CO₂ per MWh), sector's total CO₂ emissions was 3 488.1 Gg and, again, diesel and petrol fuels were the main emitters of CO₂. Fig. 1 shows the distribution of energy consumption and emissions by energy carriers in 2014.

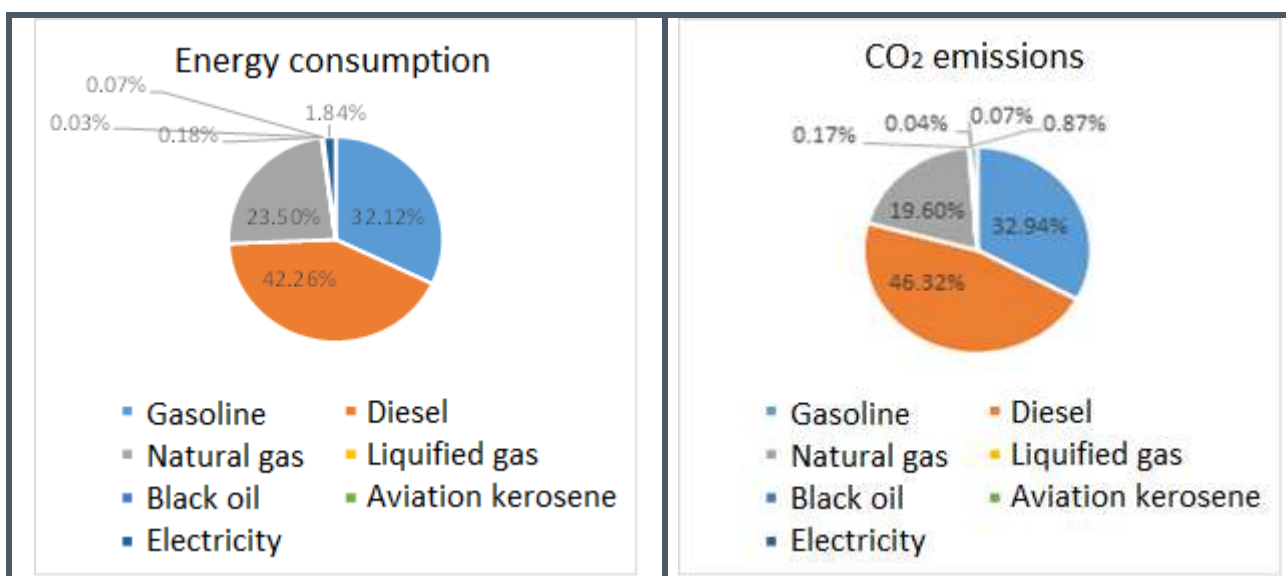


Fig. 1. Energy consumption and CO₂ emissions in transport sector by energy carriers, 2014

In recent years, GHG emissions from transport sector have increased significantly. For instance, CO₂ emissions from fossil fuel consumption is 211.3% higher than corresponding figure of 2000, 98.2% higher than the value of 2006, and 35.5% higher than the consumption of 2010.

Fig. 2 provides the information regarding the shares of different transportation types in sector's total energy consumption and carbon dioxide emissions. Apparently, road transport is the main player in both cases,

¹ Pipelines are also part of the transport sector, but they are not addressed in this chapter as the base for LEDS GHG inventory and mitigation analyses — Energy Balance published by the GeoStat, — does not cover energy consumption of pipelines sub-sector (losses and volatile emissions from pipelines are examined in Energy chapter).

² Contains employment and turnover figures for category “Complementary transportation, tour-operators activity”.
http://geostat.ge/cms/site_images/_files/english/transport/by%20kind%20of%20economic%20activity/number%20of%20persons%20employed.xls

while the shares of the internal aviation and the marine transport are negligible. As the cumulative shares of internal aviation and marine transport do not exceed 0.13% neither for energy consumption nor for the CO₂ emission figures, most of the emission reduction measures are directed to affect road transport and railway.

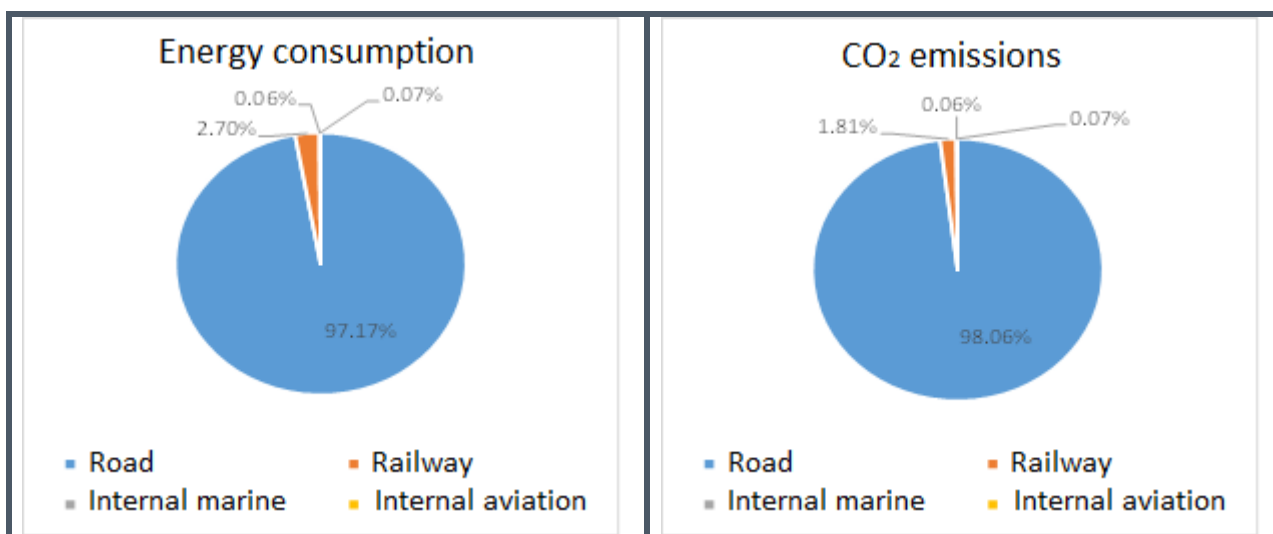


Fig. 2. Energy consumption and CO₂ emissions in transport sector by transportation types, 2014

Despite passenger and freight turnover figures are well-recorded for railway, statistical data for road transport is often contradictory or unavailable and thus a precise information regarding overall passenger and freight turnover is not accessible for Georgia. Based on obtainable incomplete information, EC-LEDS project evaluated passenger and freight turnover in pair with fuel consumption and emission figures for various types of transport (passenger cars, buses, minibuses, light-duty commercial vehicles, trucks, etc.) in the country. Analyses within the framework of the project provided transport sector's activity and energy intensity insights, and secured some ground for conclusions. Nevertheless, to further improve data quality and to reach statistical preciseness, substantial additional work is necessary. Conducted analyses, official statistics from GeoStat and other available surveys³ were used to construct Box I. This box contains information regarding main figures for road transport and railway subsectors.

Box I. Main characteristics of selected transport sub-sectors in Georgia

- Passenger transport constitutes for 60.8% of total energy consumption in road transport, 26.5% is consumed by freight transport and the rest — by other means of road transportation, like special vehicles (agricultural vehicles, fire trucks, etc.), military transport, etc.;
- Private passenger cars contribute to 69% of total passenger turnover, while the share of railway transport is just a 5%, half of which is due to Tbilisi Metro. As far as the share of passenger cars is 69%, its share in total energy consumption is 89% as it is one of least efficient means of passenger transportation;
- Road transport and railway hold, respectively, 58% and 42% shares of total freight turnover in Georgia;
- Railway freight turnover declined by 20% compared to 2010, and by 33% compared to 2006. For the same periods, the decline in passenger turnover was 16% and 32% respectively;
- Despite its 42% share in total freight turnover, railway's share in total energy consumption is just 8% and only 5% in total emissions. The reason for this is that railway is the most efficient and least emitting mean of freight transportation, and increasing its share in total freight turnover will further reduce total energy consumption and emissions in transport sector;
- According to GeoStat, in 2014 there were 906.7 thousand road vehicles in Georgia (738.8 thousand of them were passenger cars). In 2014, number of road vehicles was 198% higher than in 2000, 77% higher than in

³For further information see "Transport Sector Overview", Sustainable Development Centre "Remissia", 2016, EC-LEDS Project Report.

2007, and 38% higher than in 2010;

- Most of registered cars are used vehicles from Europe. Just 1% of them is less than three years old, while more than 90% were produced 10 years ago;
- At present, biofuel is neither produced nor imported by fuel importers in Georgia. But, Ilia State University carried out a project during 2012-2014 in the framework of which, they planted (10 hectares in Dedoplistskaro Municipality) and harvested canola plant for the first time in Georgia and produced bio-diesel from it. According to results, price of bio-diesel equals to 1.10-1.20 GEL per liter, thus it can compete with traditional bio-diesel.

Box 2 lists the main barriers faced by Georgia's transport sector sustainable development and these barriers should be stipulated adequately in low-emission development action plan.

Box 2. Barriers to implement emission reducing measures in the selected sub-sectors of Georgia's transport sector

- At the present stage the unified vision and policy of Georgia's transport development, which would treat all the transport types and regions as a combined complex is not yet formulated;
- Nationwide policy for managing and developing transport sector in Georgian cities, or an authority that would define urban transport development directions (or, in general, priorities for sustainable urban development), would deliver nationwide policies, regulations and visions for coordinating to-do lists of different municipalities, do not exist;
- Transport sector's statistical data is not collected regularly, and the monitoring based on this data is not carried out (government only monitors selected economic figures), that in opposite case would support the country to work out efficient policy;
- Regional public road transport and passenger railway do not meet costumers needs with respect to traveling frequency or service quality, and a major share of passengers travel by private cars. In recent years attempts were made to improve service quality, but the standard is still low in various towns or villages: neither policy to improve services, nor minimum standard requirement exist. Safety and environment protection standards are not monitored and respective penalties are not clearly defined;
- Registering and regulating taxis is just an issue for discussions yet. Consequently, service quality is low and competition rules are not followed between taxis and public transport, as well as between different taxi service providers;
- Roadworthiness tests for private cars is not mandatory, while the fuel quality, which affects GHG emission levels and air quality, is not fully equaled to EU standards;
- Heavy-duty trucks damage the road infrastructure approximately by \$0.50 per km, e.g., a multi-axle truck that travels 400km in the country causes \$200 damage⁴ and this amount is much higher than transit fee fixed at 200GEL;
- The sharing of freight turnover between road transport and railway is not optimal and the latter can operate with higher loading. Number of passenger carriages is limited and declines, and the infrastructure fails. Railway struggles to compete with road transport as a result of inadequate fiscal policy in road transport;
- First legal steps to introduce biofuel on national market have already been taken, and a biodiesel, as a clean diesel fuel, paired with oil diesel of 20% biodiesel content already own their respective codes in Georgian Common Procurement Vocabulary Code. Nevertheless, excise tax of 150 GEL per one ton on biofuel production (or import) is a main obstacle for broad introduction biodiesel to the consumer market.

⁴ "Georgia Transport Sector Assessment, Strategy, and Road Map", Asian Development Bank 2014.
<http://www.adb.org/sites/default/files/linked-documents/cps-geo-2014-2018-sd-02.pdf>

2. Transport Sector Low Emission Development Strategy Vision for 2030

Georgia produces high share (80% in 2014) of its total electricity generation using its abundant hydro resources. Respectively, Georgia LEDS aims to increase this share further and also introduces wind- and solar-power plants. This will keep Georgia's electricity as almost clean electricity for a long prospective.

Taking into account the access to said clean energy source, long-term emission reduction strategy in the transport sector envisions extensive use of electricity as a solution. The emphasis will be to utilize electricity-run freight (railway) and public transport means (railway, metro, tram, cable-car, electric bus, etc.). At the same time, fiscal and financial measures will incentivize using electric cars and support broadly introduction of them into private passenger transportation with additional supportive measures (probably, in post-2030 period) once the technology will be good enough. Besides the electric cars-related measures, pre-2030 period strategy also envisions other measures meant to renew car fleet, to improve fossil fuel quality and alike. These strategies are discussed in details below.

Pre-2030 period transport sector LEDS has three main directions:

- Car fleet and fuel quality;
- Freight transport;
- Passenger transport and urban transportation.

Road transport fleet and fuel quality improvement. Attempts to reduce GHG emissions and to improve air quality as well as public health will benefit from fulfilling this priority of Georgia's transport sector LEDS. At present, outdated cars construct the high share of Georgia's transport fleet, and the demand and supply for old, second-hand and high-emission cars is high. Number of cars is increasing steadily and fast and the process will continue in the future. This will further deteriorate air quality and public health, will increase the overloading of road traffic and will have adverse effect on the quality of life and public welfare. Average age of Georgia's car fleet equals to 20 years and most of the cars are technically impaired. Technical standards and a regular roadworthiness tests apply only to selected types of transport.

Renewal/refreshment of car fleet. To meet this goal, obligatory roadworthiness tests will check various technical characteristics of the car fleet by 2017. In the short-term it is planned to introduce fiscal stimuli mechanism — reducing import tax for purchasing new and low-emission (hybrid, electric) cars or increasing similar tax for importing old cars — to support purchasing new and low-emission cars. In the long-term, importing old cars will be completely prohibited that will be a preliminary step towards preparing and implementing a legal framework for imported/purchased cars' GHG emission standards⁵. These standards might be enforced after 2030.

Improving fuel quality. Fuel quality requirements are lower in Georgia than those of EU. But, it is important that the rapid adoption of EU standards will increase fuel prices, thus Georgian government works hard to synchronize national standards to the EU ones step by step. The government plans to work in the way that by 2020 in the country Euro-5⁶ standard for vehicle fuel will be introduced. Using biofuel in transport sector can significantly improve overall fuel quality in Georgia. In addition to reduced CO₂ emissions, biofuel provides advantages like being free of heavy metals and not polluting air with lead, or Sulphur dioxide, or different cancerogenic or other harmful admixtures. Nowadays, biofuel is not commercially available in the country, but surveys showed that there is potential to produce biofuel in Georgia in a commercially profitable way. Consequently, in the abovementioned strategy the emphasis is on producing biofuel domestically. With this respect, at the first stage (short-term) it will be necessary to carry out large-scale project, which will examine biodiesel commercialization potential and precisely calculate emission factors for the whole cycle for biodiesel production. This will be used to verify that biodiesel is

⁵ EU regulations: CO₂ and Cars Regulation (EC) No 443/2009 და CO₂ and Vans Regulation (EU) No 510/2011 თანახმად.

⁶ EU directive: 2003/17/EC

sustainable. Also, adoption of biofuel standards and biofuel certification by a designated authority will be important. The barriers (financial, technological, etc.) faced while realizing this project should be used to prepare and implement biofuel production supporting policy, including the fiscal policy like abolition of excise tax on biofuel, etc. Simultaneously, target share of biofuel consumption in road transport should be defined by 2030.⁷

The main strategy of developing **freight transport sub-sector** in Georgia is promoting railway freight transportation and increasing its compatibility as it is the least-emitting mean of transportation. With this respect, to improve railway traffic capacity, increase the speed and service quality, numerous infrastructural projects are planned. At the same time, railway freight transportation cannot compete with road freight transport that pays less taxes than the value of the damage they impose on infrastructure⁸. Due to this, for longer period it is planned to practice fiscal policy suitable to make the level playing field between road and railway transport, and will support competition.

For **passenger transport** the main strategic direction is to work out multi-modal transport system consisting of intercity and urban sustainable public transport. Nowadays, intercity public transport service quality is low and not regulated. Besides, the railway infrastructure goes out of order and declines as the time pass. Because of this, further improvement of road transport (in the short-term) and renewal of railway infrastructure (in the long-term) is planned. Also, as the taxis are neither registered nor regulated in any ways, it is necessary to start their regulation and to keep their registry.

Box 3. Transport sector LEDS

Vehicle fleet and fuel quality

Short-term (2017-2025):

- Introducing obligatory tests for vehicles roadworthiness;
- Carrying out fiscal policy to discourage the import of old cars and encourage the import of low-emission (electric, hybrid) ones;
- Increasing fuel quality standards gradually and introducing government control mechanism;
- Analyzing the potential for biofuel production commercialization.

Long-term (2026-2030):

- Introducing and enforcing Euro-standards to control cars toxic emissions;
- Defining standards and sustainability criteria for biofuel.

Freight transport

Short-term (2017-2025):

- Developing railway infrastructure;
- Taxing road freight transport for using certain types of road infrastructure.

Long-term (2026-2030):

- Assessment of the work done and revision of perspectives.

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Passenger transport and sustainable urban development

Short-term (2017-2025):

- Developing intercity public transport;
- Improving taxi registration;
- Carrying out/supporting transport sector measures defined in Georgian municipalities' sustainable energy development plans.

Long-term (2026-2030):

- Rehabilitation/development of passenger railway transport (railway, metro);
- Carrying out/supporting the continuation of energy sector sustainable development plans on Georgian municipalities' level till 2030.

⁷ According to the requirements of EU Renewable Energy Directive (2009/28/EC).

⁸ Asian Development Bank, 2014. [Georgia Transport Sector Assessment, Strategy, and Road Map](#). Manila: Asia Development Bank.

In the process of low emission transport development emphasis will be made on the **sustainable development of urban transport** and to the support of cities that have worked out sustainable energy action plan in the framework of Covenant of Mayors (CoM). Measures in this agreement cover urban public transportation, pedestrian and cycling route development, carrying out parking policy and other identified or planned measures on city level. In pre-2020 period, in the framework of National LEDS, emphasis will be made to support the development of existing plans (cover period until 2020), while after 2020 municipal-level plans will be prolonged till 2030 and the involvement of more municipalities in the process of CoM and supporting to carry out planned measures will take place. In this procedure the realization of population behavior modifying measures, which aim to reduce people's chaining to private cars and popularizing clean public transport technologies, will be important.

Box 4 lists transport sector LEDS targets defined according to given strategy:

Box 4. Targets of transport sector LEDS for 2030	
Vehicle fleet and fuel quality	
•	15% improvement of transport fleet average energy efficiency compared to 2014
•	Introducing obligatory fuel quality standards according to Euro-5
Freight transport	
•	Increasing railway's share in total freight turnover – at least up to 50%
Passenger transport and sustainable urban development	
•	Railway's share in total passenger turnover – at least 9%
•	Road public transport share – at least 20%
•	Reducing urban transport sector's GHG emissions (approximately by 20%) on urban territories according to targets defined in SEAPs

The next chapter of emission reduction strategy measures are discussed according to which measures carried out in transport sector can reduce 1 517 gg CO₂ equivalent emissions annually by 2030. Note that transport sector particularly saves 1 572 Gg emissions — 23.2% of total projected emissions of sector for 2030, — but measures carried out in transport sector (railway measures, electric car measures, etc.) increases electricity consumption and thus increases emissions in electricity generation sector. In electricity generation sector emissions will be increased by 55 Gg and this equals to 2.6% of projected emissions in electricity generation sector by 2030. Fig 3 demonstrates projected increases of GHG emissions in transport and electricity generation sector. Blue line on each graph is basic increase according to BAU scenario, while the purple one shows increase in case if only transport sector measures are carried out.

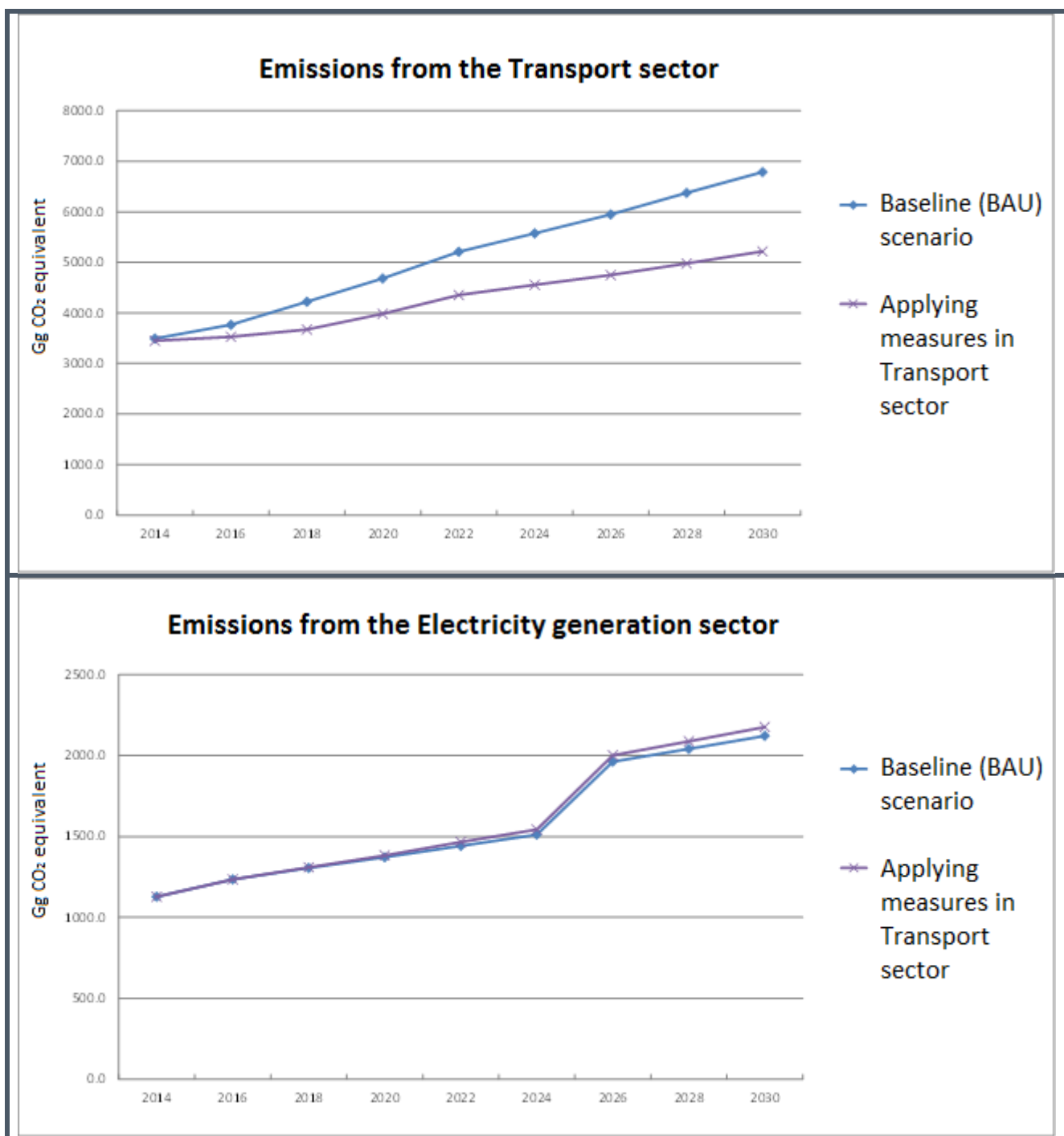


Fig 3. GHG emissions projections in Transport and Energy generation sectors according to BAU and reduction measures scenarios in 2014-2030.

The most efficient transport sector measure to reduce GHG emissions are to support and increase railway freight turnover. As already mentioned above, some transport sector measures increase electricity consumption and, accordingly, electricity consumption in transport sector will increase by 738 GWh and additional 150 installed capacity will be needed by 2030.

Transport sector measures by 2030 reduce projected primary energy consumption according to 2030 BAU scenario by 20.6 PJ (5.0%), final energy consumption by 20.9 PJ (6.9%) and imported fuel consumption by 22.7 PJ (8.5%).

3. Transport sector Low Emission Development roadmap

This chapter discusses planned measures of low emission development in the transport sector. Measures cover policy instruments (fiscal policy), legal framework modification, institutional and planning measures, as well as specific infrastructural measures in the same sector. Carrying out and administrating policy instruments are significantly cheaper than transport sector infrastructure development costs and sometimes it can serve as an income source also. All other instruments related to taxation (for example, for taxis or for old cars) could serve the same purpose and they aim to reduce undesirable practice like using inefficient cars. Introducing fuel quality standards, new traffic regulations, prohibiting the import of old cars and alike instruments are also cheap solutions as their cost equals just to the costs of preparing the new laws. Despite roadworthiness test are also policy measures, they are relatively expensive as involve the testing of large number of vehicles. On the other hand, special technical organizations carry out these tests and there exist ways to recover testing costs. Expenses might be fully covered by car-owners or partly subsidized by the government. The Government can support the process, for example, by granting free land use rights for testing service providers and this lost income could be recovered in the future regarding cars' increased energy efficiency and reduced fuel consumption costs.

Though the abovementioned regulations are sometimes considered unfair as they impose high costs on car-owners, two facts should be highlighted. First of all, these additional costs internalize the social, environment protection, car accident and other external costs borne by the society into car-owners' (externality imposers) private expenditures. Secondly, these regulations encourage drivers to use safer and low-emission transport like the public one.

Below the infrastructure costs of instruments according to the said opinions are listed, but policy instrument measures costs are not calculated.

Measure	TPOLI: Road transport technical requirements
Type	Legislative
Implementing body	Ministry of Economy and Sustainable Development of Georgia (initiator)
Timetable	2017 – Introducing road worthiness tests for road transport; 2017 (for new vehicles and for vehicles engaged in international transport) - limiting the speed for certain categories of motor vehicles; 2021 (for vehicles engaged in national transport) - limiting the speed for certain categories of motor vehicles; 2017 – introducing maximum authorized dimensions; 2020 - labeling of tires with respect to fuel efficiency and other essential parameters.
GHG	CO ₂
Emission reduction for 2030	214 Gg (including the effects of TPOL2-4 measures)
Description of the measure	Road worthiness tests will become obligatory in Georgia for all types of road transport from December 31, 2017. The legislative amendment re is related to country's international responsibilities, environment situation in the country and outdated car fleet. Before the new law is adopted, road worthiness tests are mandatory only for more than 3.5 ton capacity trucks and for vehicles with more than eight seats excluding the driver. As for passenger cars, testing is voluntary. According to 3 January, 2014 Georgian Government's Decree N30, from the beginning of 2018 more than 10 components of vehicles will be

	<p>tested: Breaking system; steering and steering wheel; visibility; Lamps, reflectors and electrical equipment; axles, wheels, tires, suspension; chassis and chassis attachments; cab and bodywork; CO emissions, and etc. According to the “Road Safety” law, testing will be carried out by the Unified National Body of Accreditation accredited private company.</p> <p>For special type of newly registered vehicles and for vehicles engaged in international transport from 31 December, 2017 the maximum speed will be limited. The same will be true for vehicles engaged in national transport from 31 December, 2021. Legislative change is related to Georgia’s international obligations, to the environmental state in the country and aims to increase the energy efficiency and road safety in transport sector. Regarding the type of transport, speed will be limited to either 100 or 90 km/h, while for the transportation of dangerous goods 85 km/h limit might be applied.</p> <p>From 31 December, 2017 maximum authorized dimensions of road vehicles will be laid down. Legislative change is related to Georgia’s international responsibilities and aims to protect the environment and road infrastructure. Limits will be applied to maximum weight, length, width, height, and to other essential parameters. The measure will increase transport effectiveness as the motor works more effectively while loaded reasonably.</p> <p>From 31 December, 2020 labeling of tires with respect to fuel efficiency and other essential parameters will become mandatory. Legislative amendment is related to Georgia’s international obligations and aims to increase road safety and transport efficiency, and reduce traffic noise as well.</p>
Approximate cost	---
Assumption and evaluations	<p>The effectiveness of these measures, which increase road transport efficiency, are evaluated together with TPOL2-4. It is widely known fact, that a well-groomed vehicle consumes 3-7% less fuel than a vehicle in bad conditions⁹. Assumption for calculating emission reductions is that the efficiency of (non-electric, non-hybrid) road transport will be increased at most by 7% for 2030 as road worthiness tests as well as other factors (eco-driving, weight and speed limits, fiscal policy for purchasing new cars, etc.) given in measures TPOL2-4 affect efficiency. According to BAU assumptions, regardless of LEDS measures, energy efficiency of transport increases by 8% thanks to worldwide improvement of vehicle technologies¹⁰. Consequentially, cumulative effect will decrease the energy intensity of (non-electric, non-hybrid) road vehicles by 15% compared to 2014 figure¹¹.</p>

Measure	TPOL2: Fiscal policy in relation with old cars imports
Type	Legislative/Fiscal

⁹ Source: Technologies for Climate Change Mitigation, TNA Guidebook Series, UNEP, 2011

¹⁰ Projections for the road transport technologies efficiency development in the baseline scenario are taken from the US Energy Department database.

¹¹ Information on 2014 data on the number of road transport, run, efficiency and other parameters is given in the “Overview of Transportation sector”, Sustainable Development Centre “Remissia”, 2016, EC-LEDS project Report.

Implementer body	Ministry of Internal Affairs of Georgia (initiator), Customs Office (implementer)
Timetable	2017
GHG	CO ₂
Emission reduction for 2030	To avoid double counting of emissions reductions, these reductions are calculated in the measure TPOLI.
Description of the measure	<p>Draft law prepared by the Ministry of Internal Affairs of Georgia envisages significant increase in excise tax for more than nine years old cars.</p> <p>The excise tax will be calculated according to the difference of car production and import years per 1 cm³ of motor volume. For example, after the law is adopted, the excise tax for importing 10 years old (non-hybrid) car with 2.0-liter motor will equal to 2200 GEL, unlike current figure of 1000 GEL.</p> <p>The draft law is prepared according to draft amendment to the “Road Traffic Law” and paired with other related drafts, is an essential part for implementing road traffic safety action plan of the Ministry of Internal Affairs of Georgia.</p>
Approximate cost	---
Description	See the description of TPOLI.

Measure	TPOL3: Developing and implementing the legislative base for road transport eco-class awarding and labeling systems
Type	Legislative
Implementing body	Ministry of Environment and Natural Resources Protection of Georgia (initiator)
Timetable	2018-2022
GHG	CO ₂
Emission reduction for 2030	To avoid double counting of emission reductions, these reductions are calculated in the measure TPOLI.
Description of the measure	The measure aims to develop and implement the legislative base for road transport eco-class awarding and labeling system, and calculating import tax with respect to transport eco-class. Prohibition the import of old cars is also a part of the project.
Approximate cost	---
Assumptions and evaluations	See the description of TPOLI.

Measure	TPOL4: Eco-driving courses for drivers
Type	Legislative
Implementing body	Ministry of Economy and Sustainable Development of Georgia

Timetable	2017-2020
GHG	CO ₂
Emission reduction for 2030	To avoid double counting of emissions reductions, these reductions are given in the measure TPOLI.
Description of the measure	According to Georgia's international obligations, for the drivers of certain type road transport, the requirements of initial qualification and periodic training will be introduced. Respective EU Directive, among other requirements, states that the driver should be able to use fuel, car inertia and gear shift more efficiently, and avoid the wearing out of car parts.
Approximate cost	---
Assumptions and evaluations	See the description of TPOLI.

Measure	TPOL5: Encouraging the purchase of electric and hybrid cars
Type	Legislative/Fiscal
Implementing body	Parliament of Georgia (initiator)
Timetable	2016-2017
GHG	CO ₂
Emission reduction for 2030	Cumulative effect - 69 Gg 83 Gg emissions reduction in transport sector, 14 Gg increase of emissions in electricity generation sector.
Description of the measure	<p>From 1 May, 2016 import tax on 0-6 year old hybrid cars was halved, that is a big step for improving ecology in the country. For example, if the hybrid car produced in 2010 is imported, the excise tax levied on it will be 875 GEL and import tax will be 81.25 GEL, compared to 1750 and 162.5 GEL for ordinary cars.</p> <p>According to existing law, excise tax is nullified only for electric cars, while for hybrid ones it is calculated in compliance with the car age and motor volume.</p> <p>In perspective, hybrid cars might be freed from excise and import taxes.</p> <p>To encourage the use of electric cars, it will also be helpful to:</p> <ol style="list-style-type: none"> 1. Work out financial schemes to encourage the purchase of electric cars; 2. Initiate and implement infrastructure development strategy for electric cars. <p>Abovementioned steps will increase the share of electric and hybrid cars to significant levels.</p>
Approximate cost	---
Assumptions and evaluations	<p>By 2015, 46 electric and 1961 hybrid cars are registered in Georgia. Their respective shares in passenger car fleet are 0.005% and 0.02%.</p> <p>In the EU the share of electric and hybrid cars in car fleet equals to 3%, and in some countries this figure is even higher for newly purchased cars, though fossil fuel-run cars still dominate due to the low purchase and</p>

	<p>operational costs. Accordingly, financial schemes are needed to change the situation in the favor of eco-friendly cars, the share of which will increase significantly if they become cheaper and more perfect.</p> <p>To evaluate the effects of the measure, it was assumed that the share of hybrid cars will reach 5% and the share of electric cars will reach 1% of car fleet in Georgia by 2030.</p> <p>Emissions reduction is calculated by MARKAL-Georgia model in respective assumptions framework.</p>
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Measure	TPOL6: Fuel eco-labeling
Type	Awareness rising/Incentive
Implementing body	Ministry of Environment and Natural Resources Protection of Georgia / Atmospheric Air Protection Service (initiator) Ministry of Environment and Natural Resources Protection of Georgia / Environmental Information and Education Centre (implementer)
Timetable	2017-2030
GHG	--
Emission reduction for 2030	Not calculated
Description	<p>The measure aims to increase the share of clean fuel on the market and provide more information to population regarding this type of fuel. Also, it intends to increase competitiveness between oil-product importers.</p> <p>Eco-labeling will cover car fuels (petrol, diesel) and its parameters will comply with EU standards (Euro-5 for petrol, Euro-4 and Euro-5 for diesel). Individuals or entities should apply to implementer body and will get the fuel quality certificate according to mutual contract ¹². The certificate will be issued based on given fuel brand quality certificate or laboratory conclusion. The Ministry of Environment and Natural Resources Protection will monitor the use of eco-label and will periodically checkup fuel quality. If the eco-label requirements are violated, the Ministry will confiscate the labeling rights and charge penalty fees. Furthermore, the ministry will control unauthorized use of the label and will make the information publicly available via media sources.</p>
Approximate cost	---
Assumptions and evaluations	<p>The use of cleaner and high quality fuel instantly reduces transport emissions, though the effect is strong for some local pollutants and not for GHG emissions. Nevertheless, if drivers and businessmen working in the field treat transport exhaust induced environment pollution with caution, GHG emission could also decrease. Also, focusing on fuel quality in the future will increase public responsibility regarding the GHG emissions.</p> <p>Increasing fuel quality and decreasing emissions of local pollutants lessens GHG emissions as well as public health costs and expenditures.</p> <p>Thus, improving fuel quality and adopting corresponding standards are one of important directions in the way of country's sustainable development.</p>

¹² Eco-label validity, terms and fees (including operational and other costs) of use, label issuers' and holders' rights and responsibilities, penalties for violating the agreement, etc. will be defined in mutual contract.

Measure	TPOL7: Improving fuel quality
Type	Legislative
Implementing body	Ministry of Environment and Natural Resources Protection of Georgia / Atmospheric Air protection Service
Timetable	2016-2020 (stage by stage)
GHG	-----
Emission reduction for 2030	Not calculated
Description	The measure aims to gradually synchronize national fuel quality standards to EU ones steadily and it is planned to adopt Euro-5 standards by 2020. The measure also aims to introduce state control on biofuel standards.
Approximate cost	---
Assumptions and evaluation	See the description of TPOL6.

Measure	TPOL8: Working out integrated and coordinated tariff policy for freight transport
Type	Planning, Fiscal
Implementing body	Ministry of Economy and Sustainable Development of Georgia, Ministry of Regional Development and Infrastructure of Georgia, Ministry of Finance of Georgia
Timetable	2017-2020
GHG	CO ₂
Emission reduction for 2030	Cumulative effect – 686 Gg 698 Gg CO ₂ emissions will be saved in transport sector. CO ₂ emissions will be increased by 12Gg in electricity generation sector. Including the impact of the measure TMEAI.
Description of the measure	<p>The measure aims to increase railway turnover using relevant tariffs policy. The survey of railway cargo turnover showed that the unfair fiscal policy in favor of road transport for either road or railway infrastructure use reduces road transport prices and railway turnover suffers. Railway covers its infrastructure damage costs, while road freight transport companies do not, and transit trucks pay less than the cost of damage they impose on road infrastructure.</p> <p>The prime aim of the measure is to create level-playing field for road and railway transport using fiscal policy. Country's ecology and Georgian Railway will benefit thanks to the measure, while the competition on freight market will become fairer and government will save important investments for of road infrastructure improvement.</p> <p>The measure involves following activities:</p> <ul style="list-style-type: none"> – Revising tariffs for transit road freight (possible, according to tons-km and emission class of the truck); – Taxing trucks for using road infrastructure. <p>Surveying freight transport flows and carrying out respective economic</p>

	analyses to define optimal tariffs are necessary pre-conditions.
Approximate cost	---
Assumptions and evaluations	<p>At present railway transfers 35% of total freight, while 65% is moved by road. According to experts' assessment, this causes inefficiency and railway should be loaded to the higher extent¹³. To achieve the goal, fiscal policy paired with infrastructure policy of measure TMEAI (increasing railway mobility and traffic capacity) are necessary. The assumption is that abovementioned steps will increase railway share in freight turnover to 50%.</p> <p>Emissions reduction is calculated by MARKAL-Georgia model in respective assumptions framework.</p>

Measure	TMEAI: Improving railway infrastructure
Type	Infrastructural
Implementing body	Georgian Railway
Timetable	2015-2025
GHG	CO ₂
Emission reduction for 2030	Emission reductions are calculated including the effects of TPOL7.
Description of the measure	<p>At present numerous projects are being carried out in Georgia to improve and widen railway infrastructure and they aim to attract more freight. Two most important projects to achieve the goal and to decrease emissions are:</p> <ol style="list-style-type: none"> 1. Project “Fast Railway”. Rehabilitation and overhaul of 340 km railroad section on Tbilisi-Batumi route: renovation of rail and electricity supply systems, repair of bridges and tunnels, building 38 km bypass and new 8 km-long tunnel. The project will increase the capacity and the speed on problematic sections of the route and will decrease the duration of the trip by 30-40 minutes. At present, railway capacity equals to 21 million tons annually. According to the plan, this figure will reach 50 tons by 2019 and 120 tons — after arranging all electric-engineering systems in post-2019 years. 2. Baku-Tbilisi-Kars is a new transport corridor that links Azerbaijani, Georgian and Turkish railways to each other. The project will open passenger and freight railway corridor Caspian Sea-Europe. Railway authorities believe that the new line will increase freight turnover (namely, the container traffic) and shift current freight routes (namely, dry freight, which is transported by trucks) between Turkey, the Caucasus region, Russia, and the Middle East Asian countries. In initial stage, new arterial line will be able to serve about 1 million passengers and 5 million tons of freight annually, and will increase its capacity to 15 million tons of

¹³ „GEORGIA'S TRANSPORT AND LOGISTICS STRATEGY: ACHIEVEMENTS TO DATE AND AREAS FOR IMPROVEMENTS“, Mustapha Benmaamar, Oceane Keou, Daniel Saslavsky ,World Bank 2015.

<http://documents.worldbank.org/curated/en/623591468191346382/pdf/96577-REVISED-WP-PUBLIC-Georgia-Box391464B-Final-Jan2015.pdf>

	freight for the second stage.
Approximate cost	The approximate cost of “Fast Railway” is 250 million USD, while Baku-Tbilisi-Kars line will cost approximately 775 million USD, though the figures are expected to increase in the future. Building additional electricity generation capacities (approximately 35 MW) necessary to serve increased railway turnover, will cost approximately 75 million USD (according to MARKAL-Georgia calculations).
Assumptions and evaluations	The measure is vital to increase railway freight turnover. “Fast Railway” will at least double the railway capacity (and might increase it 6 times in the future), while Baku-Tbilisi-Kars will have a capacity of 5 million tons annually. Nevertheless, barriers discussed in TPOL7 will automatically increase freight turnover and carrying out these two measures simultaneously is necessary. Aggregated effects of these measures are given in TPOL8.

Measure	TPOL9: Improving the quality of intercity passenger transport
Type	Institutional/Planning, Legislative
Implementing body	Ministry of Economy and Sustainable Development of Georgia
Timetable	2017-2020
GHG	CO ₂
Emission reduction for 2030	33Gg
Description of the measure	<p>Well-connected and high quality public transport can compete with private cars and reduce emissions, while the lack of intercity transport means and its low quality hinder tourism development. Consequentially, the availability of fast and comfortable intercity public transport is an important issue. To achieve this goal, the following activities should be performed:</p> <ul style="list-style-type: none"> • Improving the accounting of passengers, incomes and transportation means. At present, information regarding the intercity routes, transportation means and passenger turnover is not available, but having collected this information on regular basis is a necessary pre-condition for working out respective development policy; • Carrying out profitability studies and identification of respective financial stimuli system for intercity transport; • Defining service quality standards and monitoring them. Introducing regulations for service providers to renew and improve their bus fleet and test them regularly; • Developing information systems: unified data base regarding passenger transport service, respective web-pages, etc. On the other hand, governmental bodies (e.g., Georgian National Tourism Administration, Land Transport Agency) could select strategic routes and monitor the service quality on these routes; • The development of intercity transport infrastructure (perfection of intercity stations, choosing and improving parking sites in

	cooperation with municipality authorities). Detailed description of how the measure could be realized, is given in the World Bank report: “A policy framework for green transportation in Georgia” ¹⁴ .
Approximate cost	---
Assumptions and evaluations	Worldwide experience shows that despite the number of private cars is increasing, there always exist cheaper and more convenient means of transportation on long distances. Furthermore, well-managed and regulated bus service is statistically safer and more energy efficient. Experience also shows that good regulation and fiscal policy can increase public transport passenger turnover. For example, in the US intercity public transport (bus) is the fastest growing segment of the transport sector — it increased by 22% from 2007 to 2010 ⁶ . For Georgia conservative assumption that by 2030 passenger turnover of buses and minibuses will increase by 10%-10% was made. As a result, just 2% of total passenger turnover will shift from private cars to public transport. Emissions reduction is calculated by MARKAL-Georgia model in respective assumptions framework.

Measure	TPOL10: Taxi registration and regulation
Type	Legislative
Implementing body	Ministry of Finance of Georgia (tax register) Local municipalities (licensing)
Timetable	2017-2020
GHG	CO ₂
Emission reduction for 2030	109Gg
Description of the measure	The measure covers two different directions: <ul style="list-style-type: none"> • Private taxi registration will be carried out by local authorities who will define minimum quality standards for safety, comfortability and other parameters; • Improving the accounting of taxi amount and the revenue they get, including their tax register and accountability.
Approximate cost	---
Assumptions and evaluations	At present taxi sector is not regulated in Georgia and it is not even required to be registered as taxis. Thus, the information regarding taxi fleet is not available. In the monitoring process of Tbilisi Sustainable Energy Action Plan (SEAP), experts assumed that about 20% of cars involved in Tbilisi traffic are taxis. For the whole country corresponding figure will be lower and is assumed to equal 10%. Additional assumption is

¹⁴A policy framework for green transportation in Georgia : achieving reforms and building infrastructure for sustainability. Washington, DC: World Bank, 2012.

	<p>that after the measure is realized, the share of taxis will decrease to 5% (in majority of European countries, the share of taxis is only 1%). Taxis cover five times more distance annually than the private cars¹⁵, thus it was assumed that the distance covered by taxis that exit the market will decrease five times. Note, that the impact of this measure is partly included in other measures (developing public transport and improving its quality, supporting walking and cycling) because if a person does not use a taxi, he should switch to other means of transportation. As a result, this measure covers only 1/3 of time/distance the taxi covers, when it moves without a passenger and is looking for him.</p> <p>Emissions reduction is calculated by MARKAL-Georgia model in respective assumptions framework.</p>
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Measure	TMEA2: Development of railway passenger railway transport
Type	Infrastructural
Implementing body	Georgian Railway
Timetable	<p>Short-term (2017-2020):</p> <ul style="list-style-type: none"> • Feasibility study; • Baku-Tbilisi-Kars railway; • Increasing carriage fleet; • New metro station “University” in Tbilisi <p>Long-term (2020-2030):</p> <p>Renewal of passenger railway infrastructure and increasing carriage fleet (for example, to Kutaisi Airport, Kakheti and Akhalkalaki routes, etc.) in case if respective financial aid is identified.</p>
GHG	CO ₂
Emission reduction for 2030	<p>162Gg in total, including</p> <p>186Gg reduction of emissions in transport sector.</p> <p>24Gg increase of emissions in electricity generation sector.</p>
Description of the measure	<p>In the short-term, the measure covers increased turnover due to the opening of Baku-Tbilisi-Kars line and operation of newly purchased electric trains. In the long-term, the measure involves the renewal of passenger railway infrastructure and increasing train fleet towards strategic directions (e.g., Kutaisi Airport, Kakheti and Akhalkalaki routes, etc.). To achieve the goal, carrying out feasibility study and obtaining respective financial resources in advance is necessary.</p>
Approximate cost	<p>The cost of Georgian section of Baku-Tbilisi-Kars equals to 775 million USD though this figure is expected to be increased in the future, while the contract price of building metro station “University” is 83 000 670 GEL, and renewal of infrastructure or increasing carriage fleet requires further technical and economic study. Each carriage of new electric train costs 1.5 million euros and there are four carriages in one train, thus the total price tag is 6 million euros per train.</p> <p>To build additional electricity generation capacities (approximately, 70 MW) to meet increased demand from railway, 140 million USD are needed (according to MARKAL-Georgia calculations).</p>

¹⁵ Tbilisi SEAP Monitoring Report, Sustainable Development Centre “Remissia”, USAID EC-LEDS project, 2015.

Assumptions and evaluations	<p>In 2006 railway passenger turnover reached 9% of total passenger turnover and this figure decreased to 5% in 2014. The cause of decrease is the increased amount of private cars, wearing out railway infrastructure and reduction of train fleet. According to the assumptions, after infrastructure and service quality is improved, railway passenger turnover will return to 2006 level (9%) for 2030.</p> <p>Emissions reduction is calculated by MARKAL-Georgia model in respective assumptions framework.</p>

Measure	TPOL11: Working out nationwide sustainable urban transport development policy
Type	Planning/Institutional (Vertical Nationally Appropriate Mitigation Action (VNAMA) measure might be adopted)
Implementing body	Ministry of Economy and Sustainable Development of Georgia
Timetable	2018-2030
GHG	---
Emission reduction for 2030	The measure is envisioned as a supportive activity for other urban development measures and emission reduction for this particular measure has not been calculated separately
Description of the measure	<p>Measure aims to carry out some activities on municipal level and includes following activities:</p> <ul style="list-style-type: none"> – Defining guidelines for sustainable urban transport planning and investment programs; – Defining technical and environment protections standards for sustainable urban transport development on municipal levels; – Processing urban transport data base and working out experience sharing mechanisms; – Financing municipal projects and/or supporting them to obtain funds.
Approximate cost	---
Assumptions and evaluations	--

Measure	TMEA3: Improving urban public transport
Type	Technological
Implementing body	Municipalities
Timetable	2015-2020 (for SEAPs prepared till 2016) 2021-2030 (for other municipalities)
GHG	CO ₂
Emission reduction for 2030	55 Gg

Description of the measure	<p>This measure incorporates all sustainable public transport development activities discussed in the SEAPs of CoM subscriber cities. They are:</p> <ul style="list-style-type: none"> Increasing municipal transport fleet (in those municipalities where municipal transport enterprise already exist); Setting up and developing municipal transport system (in municipalities where municipal transport system does not exist yet); Improving public transport service quality and etc.
Approximate cost	Compared to BAU scenario, investment costs of purchasing new buses by the municipalities equals to 52 million USD (according to MARKAL-Georgia calculations). This amount do not cover additional costs of building bus stops and arranging bus parking sites.
Assumptions and evaluations	<p>To evaluate the result of the measure, six Georgian city (Tbilisi, Batumi, Kutaisi, Gori, Zugdidi, and Telavi) SEAPs were examined. Analysis showed that carrying out all measures of these six SEAPs will shift 2.3% of total passenger turnover from private cars to public transport. For Tbilisi and Batumi, where 53% of Georgia's total population lives and municipal transport enterprises already exist, respective figure equals to 1.5%, while in other four cities 0.8% is the case.</p> <p>As far as 2030 evaluations are concerned, it is assumed that for Tbilisi and Batumi switching rate (1.5%) will remain the same, while in 30% of other cities new municipal transport enterprise will be set up and almost 85% of total urban territories will be covered. These steps will further increase the share of public transport by 1.5%, thus cumulative effect for switching of passenger turnover form private cars to public transport will reach 3.8% by 2030.</p> <p>Emissions reduction is calculated by MARKAL-Georgia model in respective assumptions framework.</p>

Measure	TMEA4: Clean public transport
Type	Technological (substitution)
Implementing body	Municipalities
Timetable	2015-2020 (for SEAPs prepared till 2016) 2021-2030 (for other municipalities)
GHG	CO ₂
Emission reduction for 2030	Total - 0.6Gg
Description of the measure	<p>Measure aims to substitute diesel-run buses with either natural gas- or electricity-run buses in the cities. Besides, while purchasing a new bus, its lifetime fuel consumption and environment damage (caused by carbon dioxide, nitrogen oxides, non-methane hydro carbonates and particulate matter emissions) costs would be taken into account. This is a requirement of EU Clean Transport Directive, which was signed by Georgia and should be enacted in six years' time.</p>
Approximate cost	While purchasing cleaner transport than those given in BAU scenario (i.e., compared to diesel-run buses), investment costs increase by 11

	million USD for the period of 2016-2030 (according to MARKAL-Georgia calculations)
Assumptions and evaluations	<p>Tbilisi SEAP measure planned for 175 buses shifts 11% of total bus passenger turnover from diesel-run buses to natural gas-powered buses. Furthermore, Batumi city authorities plan to purchase 20 new electric buses in the near future.</p> <p>To evaluate the measure, it was assumed, that for 2030 municipal bus fleet (60% of total bus fleet used for passenger transportation) will run on clean energy, while each vehicle's technology share was calculated by MARKAL-Georgia optimization tool. This tool takes into account prices and intensity and gives a green light to natural gas-run buses.</p>

Measure	TMEA5: Supporting walking/cycling/moped traveling
Type	Awareness rising, infrastructural
Implementer body	Municipalities
Timetable	2015-2020 (for SEAPs prepared till 2016) 2021-2030 (for other municipalities)
GHG	CO ₂
Emission reduction for 2030	157 Gg
Description of the measure	<p>This measure incorporates walking/cycling/moped travel measures discussed in the SEAPs of CoM subscriber cities. They are:</p> <ul style="list-style-type: none"> • Creating corresponding infrastructure (pedestrian crossings, bicycle trails, pedestrian bridges, etc.); • Awareness rising campaigns and behavior modifying programs and others.
Approximate cost	The measure embraces the costs of developing pavements, ramps, road-crossings, bicycle-tracks and alike infrastructure. It will be carried out by municipalities and the costs will be calculated separately for each municipality according to their special needs and plans.
Assumptions and evaluations	<p>To evaluate the effects of the measure, six Georgian city (Tbilisi, Batumi, Kutaisi, Gori, Zugdidi, and Telavi) SEAPs were examined. Analysis showed that carrying out of measures envisaged in these six SEAPs will reduce passenger turnover across the country by 1.5% and 0.05% of passengers will shift to mopeds (only Telavi SEAP foresees the moped measure). It is assumed that by 2030 the effect of the activity will increase further and will spread on other cities too (whole urban territory will be covered). As a result, private car passenger turnover will decrease by 3%, while mopeds' share will increase by 2.4% and they will cover 50% of total urban territories.</p> <p>Emissions reduction is calculated by MARKAL-Georgia model in respective assumptions framework.</p>

Measure	TMEA6: Parking policy and other restrictive measures
Type	Local regulations, fiscal
Implementing body	Municipalities

Timetable	2015-2020 (for SEAPs prepared till 2016) 2021-2030 (for other municipalities)
GHG	CO ₂
Emission reduction for 2030	14 Gg
Description	<p>This activity incorporates discussed in the SEAPs of CoM subscriber cities. The measure aims to increase private car-owners expenses and reduce the incentives of using private cars. The measure includes:</p> <ul style="list-style-type: none"> • Restricting parking spaces (in favor of walking areas); • Pricing parking spaces reasonably <p>and others.</p>
Approximate cost	----
Assumptions and evaluations	<p>To evaluate the effects of the measure, six Georgian city (Tbilisi, Batumi, Kutaisi, Gori, Zugdidi, and Telavi) SEAPs were examined. Analysis showed that carrying out all measures of these six SEAPs will reduce private passenger turnover across the country by 0.11%. According to evaluations, the effect will increase for 2030 and will spread on other cities too, and result in the decrease of total passenger turnover by 0.5%. Emissions reduction is calculated by MARKAL-Georgia model in respective assumptions framework.</p>

To specify calculations and improve planned policies further, supporting/carrying out following studies is necessary:

Box 3. Surveys Suitable to Improve Transport Sector Policy in LEDS Framework

- Study and regular monitoring of road transport passenger and freight turnover;
- Evaluation of road transport turnover across the country, assessment of its economic feasibility and competitiveness compared to railway;
- Feasibility study for passenger railway development;
- Study of biofuel commercialization prospects;
- Urban transport development strategy/recommendations and national support program (possibly VNAMA).